546.1
428.41

AUTOGIRO SPRAYING EXPERIMENT AT PROVIDENCE, R. I., APRIL 22, 1936.

Purpose: To test the efficiency of distributing apparatus in its present stage of development; and to observe the action of the autogiro as a spraying device as influenced by such things as visibility, wind, other meteorological factors, topography, and the control of spray distribution generally.

A 5-acre plot (270 x 900 feet) of red pine, 25 to 30 feet in height, was laid out and treated between 3:00 and 4:00 P.M., April 21. The pine planting was about 25 years old, and very dense.

During the treatment a variable wind estimated to be between 6 and 10 miles per hour blew nearly lengthwise of the plot, with some variations in direction occurring at different parts of the plot at the same time. Wind velocity, humidity, and temperature might be obtained from the Providence Weather Bureau Station. The sky was partly cloudy.

The pilot distributed 150 lbs. of lead arsenate (350 lbs. of water-oil-lead arsenate mixture) in two loads of 225 lbs. each. This would be an average of 30 lbs. per acre. This required 11 minutes in the air, making the treatment flying one way only (i.e., against the wind). Flying both ways with and without cross winds should be tested. The pilot circled the plot twice to fix the outline of the plot in his mind. The 40 gallons of mixture was put out in approximately 5 swaths totaling roughly 5,000 feet. This is a delivery of about 40 gallons per minute. The swaths were roughly 50 feet in width, and there was some overlapping, except for a strip of about 75 feet down the middle of the plot where the foliage was not touched by the spray. The wind direction shifted during the treatment and there was not enough spray mixture left to cover this center strip. In this connection it seems that much of this difficulty could be taken care of by increasing the width of the swath to say 100 feet, and by attempting to overlap about 25 feet on each side. With more experience the pilot should be able to fly lower and with better control of the spray. There should also be a gauge of some sort connected to the

tank to show the quantity of mixture in the tank at any time. Rate of flow should be correlated with speed of the giro if possible, and the pilot should be able to conveniently vary the rate of flow from 10 to 60 gallons per minute. The tank should be made of light, thin aluminum. A dosage of 15 to 30 pounds of lead arsenate per acre will probably be required.

The plot was marked with 5 white flags placed at approximately 50 ft. intervals at each end. The flags were attached to the ends of bamboo poles (obtained from the Frost Insecticide Co., 6 Mill Street, Arlington, Mass.) The poles were tied to tree trunks so that the white canvas flags showed above the canopy. Small white balloons should also be tried.

The spray mixture was prepared in a 10-gallon tub by adding gradually (while stirring with a paddle) 25 lbs. of Grasselli lead arsenate to 5 gallons of water. As soon as water and arsenical were mixed, 1½ gallons of linseed oil was stirred into the mixture to act as a sticker.

It was roughly estimated that about 2/3 of the spray deposited in the trees and about 1/3 fell through to the ground. The distribution through the canopy was very good. The distribution should be tested on deciduous foliage also.

The atomization during the first 3 swaths, was very good, but towards the end of the last load there were many spots on the ground plates of as much as 1/8 inch in diameter. This might be due to one or more of the several imperfections, including the possible need for cleaning of apparatus, drippage from the fuselage, slowing up of rotors by friction, differences in flow, and differences in air pressure against the rotors, etc. There seems to be no doubt that the problem of atomization can be adequately solved.

The addition of the arsenicals to the liquid increases the volume only 11 percent.

Dusting apparatus, using dust adhesives, should also be tested.

Further experiments should be outlined in such a way as to find out all the

difficulties to be met in autogiro spraying and dusting; to develop means of remedying these difficulties; and to specify just how the autogiro should be constructed for forest and crop dusting and spraying. It is now evident that several modifications are desirable. The hopper or tank should be behind the pilot. At present the location of the pilot in relation to top rotor attachments is such as to seriously obstruct his view. We understand that the new wingless autogiro can carry a much heavier load, and at a much slower, more easily controlled, speed. It can also take off, turn and land within smaller areas. The costs must be reduced, and the rate of coverage and capacity increased, by:

1. Reducing the cost of the autogiro itself
2. Increasing its load carrying capacity
3. Better regulation of speed and manoeuvering ability
4. Better atomization, and a wider swath.

Further increase or decrease in capacity and in cost is affected by the following:

1. The quantity of material applied per acre. This is in direct proportion to the quantity used per acre - both as to flying time required, and as to cost of insecticide.

2. Efficiency of the ground personnel and of mixing and loading facilities.

3. Distance of the landing field from the area to be treated.

It is not to be expected that the cost of forest dusting or spraying can be reduced to 50 cents per acre - this being the average total cost per acre of treating cotton and truck crops. We should, however, try to bring the eventual cost down within $2 and $3 per acre. It now seems possible to use calcium arsenate and certain non-arsenicals.

S. F. POTTS,
New Haven, Conn.,
April 28, 1936.